

The Effect of Relationship Strength on Safety Voicing

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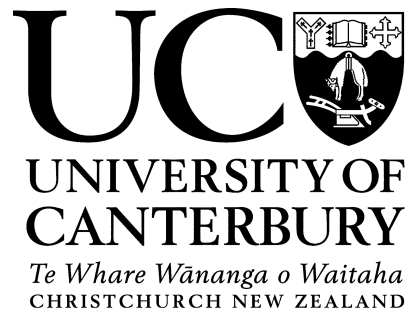


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Abstract

The purpose of the study was to test the association between relationship strength, safety voicing, and hazard neutralising behaviours. Fifty dyads completed a buzz wire game task, where the dyad members were either friends or strangers. The laboratory where these dyads completed the task contained artificial hazards that appeared to be dangerous but posed no actual threat to the participant's safety. This design was used to allow for an objective measure of safety voicing and hazard neutralising safety behaviours. The study predicted that friend dyads would engage in more safety voicing and more hazard neutralizing behaviours. Results indicated that members of friend dyads demonstrated greater instances of safety voicing to their partner within the dyad, compared to the stranger dyads. Contrastingly, there were no significant differences between friend dyads and stranger dyads in their propensity to report safety concerns to supervision or neutralise hazards. The theoretical and practical implications of the results are discussed.

Overview

To eliminate and reduce work-related hazards, employees have the option to neutralise the hazard or safety voice. The communication of safety concerns in an effort to improve unsafe work conditions is termed *safety voicing* (Tucker, Chimel, Turner, Hershcovis, & Stride, 2008), and is the primary interest variable of the present investigation. The current study aimed to investigate how relationship strength between peers of participants influences safety voicing and hazard neutralising behaviours. To analyse this relationship, participants completed a task with either a friend or a stranger within the hazard laboratory, which contained artificial hazards. This method provided for objective measures of safety voicing and neutralising behaviours.

The introduction begins by examining the costs of workplace accidents within the New Zealand context, and how this prompted the development of the Health and Safety at Work Act (2015). The success of this legislation largely relies on employee safety voicing and neutralising behaviours to reduce workplace accidents. Many accident models indicate that employees are the last defence in preventing accidents, and must be situationally aware and safety conscious to respond in a safe manner. An overview of the role of situational awareness, safety consciousness, and other predictors in promoting safety voice is provided. This is followed by an examination of how co-worker relationships might promote safety voicing and a discussion of the model of co-worker caring developed by Burt, Sepie, and McFadden (2008). This model proposes that stronger co-worker relationships encourage safety behaviours, such as safety voicing and neutralising behaviours. These predictions are echoed by results from the bystander effect literature which is also reviewed. Finally, the introduction discusses the measurement of safety voicing which has predominantly relied on self-report data, which is susceptible bias, in particular, behavioural inconsistency. How these measurement issues prompted the use of the hazard laboratory as means of obtaining objective measures of safety

voice and neutralizing behaviours is explained. The final section of the introduction specifies the purpose and hypotheses of the present investigation.

Introduction

Within one week in New Zealand, a man was wounded after the excavator he was driving slipped down a quarry bank, two people were trapped in a stock truck after it crashed, another was struck on the head with a digger bucket, one farmer was seriously injured and another died after their farm vehicles rolled, a man died on his commute to the morning milking, and two more people died and four others were severely injured after being crushed under a concrete slab (Independent Taskforce on Workplace Health and Safety, 2013). Children were left fatherless, wives became widows, and those who were permanently injured experienced chronic pain and loss of independence due to these workplace incidents (Independent Taskforce on Workplace Health and Safety, 2013). Clearly, this list of tragic events is unacceptable in the 21st century.

The examples above are not isolated, and accidents are pervasive amongst New Zealand employees. Worksafe New Zealand (2017a) reported that in 2016 alone 49 people died in work-related accidents. The number of work-related deaths has remained at this rate over the past 6 years with the lowest rates in 2015 with 43 deaths and the highest in 2013 with 57 deaths (Worksafe New Zealand, 2017a). In 2015, 1 out of every 10 full-time workers made an Accident Compensation Corporation (ACC) claim for a work-related injury (Statistics New Zealand, 2016a). Elementary occupations, such as labourers and courier drivers, had the highest rate of injury, with one in every four full-time workers making an ACC claim for a work-related injury (Statistics New Zealand, 2016b). These claims are typically for medical expenses, but when a worker experiences serious harm from a work incident they can receive payments for rehabilitation, weekly compensation, and death benefits (Independent Taskforce on Workplace Health and Safety, 2013). The costs of work-related incidents in New Zealand is estimated to be around 3.5 billion per year (ACC, 2016; Independent Taskforce on

Workplace Health and Safety, 2013). The social and economic costs of work-related accidents continue to be an unnecessary expense for the people of New Zealand.

International Comparison

New Zealand performs poorly with work safety when compared internationally. Lilley, Samaranayaka, and Weiss (2013) compared New Zealand's occupational fatal injury rates with that of eight established market economies; such as Canada, Australia, and Norway. New Zealand had the greatest number of occupational fatal injuries, even after standardising data for industry composition, to account for the significant proportion of New Zealand workers in high risk industries. New Zealand's base rate of fatal injuries was twice the size of the United Kingdom's fatal injury rate. These findings are consistent with those found by Feyer et al. (2001), which identified New Zealand as having the highest annual fatal injury rate compared with Australia and the United States. New Zealand had a fatal injury rate of 4.9 per 100,000 employees annually between 1985 and 1994. Australia and the United States had significantly lower injury rates with 3.8 per 100,000 and 3.2 per 100,000 respectively for the same time period.

Legislation

In response to New Zealand's consistently high work-related accident rates, the Health and Safety at Work Act 2015 (HSWA) was developed by the Independent Taskforce for Workplace Health and Safety (2013). This was created in an attempt to correct the failing safety systems and obtain a 25% reduction in death and serious harm due to workplace incidents by 2020 (WorkSafe New Zealand, 2017c). Previously, safety incidents were dealt with reactively, where accidents were monitored, recorded, and hazards were corrected after an accident had occurred. The HSWA attempts to engage employees and employers in proactively identifying and managing risks, in an effort to reduce the injury and death tolls (WorkSafe New Zealand, 2017b).

The HSWA requires that all people engaging in business have a duty of care to eliminate or minimise health and safety risks to the extent they have the capabilities to do so (Section 30, Health and Safety at Work Act, 2015). People conducting business are expected to ensure workers are protected from harm as far as practicable so that employees can remain healthy and safe during work (WorkSafe New Zealand, 2016). This involves the provision and maintenance of safety systems at work, which involves identifying potential work risks, providing safe methods to remove the hazards, and offering the opportunity for employees to perform work in a safe manner (WorkSafe New Zealand, 2016). Workers are required to facilitate this by participating and engaging in the safety processes. They are expected to communicate collectively about hazards or perceived work risks and work together to remove or lessen these risks (WorkSafe New Zealand, 2016). The HSWA focuses heavily on employee engagement and participation in safety communication upwards through the organisational hierarchy so that hazards can be removed systematically, by those with the power to do so.

In an effort to increase participation from workers and business owners in managing risks, the HSWA has increased the liabilities of all employees. If an employee or employer does not meet their duties set out by the HSWA, and an employee is exposed to a risk of death, illness, or injury, without a reasonable excuse, they can receive up to five years imprisonment and/or a fine of up to \$600,000 (Section 47, Health and Safety at Work Act, 2015). The organisation that individual works for can be fined up to \$3 million (Section 47, Health and Safety at Work Act, 2015). The last employee notified about a workplace hazard is liable if an accident occurs.

The HSWA posits that a good safety communication system that involves all employers and employees is necessary to minimise or eliminate risks and ultimately reduce workplace incidents. However, if employees do not take action when they come into contact with a hazard and subsequently report it, these systems fail, and accidents will continue to occur. The present

study investigates whether individuals that have known their colleagues for longer are more motivated to voice safety concerns to peers and supervisors. This association between relationship strength and safety voicing will be discussed further in the introduction. If individuals choose not to voice their safety concerns, the HSWA may be unable to rely on the communication behaviours of employees in its aim to reduce accidents in New Zealand.

Accidents: Theoretical Causal Models

To understand how to effectively prevent accidents, we must understand how they occur. Reason's (2000) Swiss Cheese model is a widely used and accepted model (Underwood & Waterson, 2014). The model proposes that there are defensive layers within an organisation that prevents accidents from occurring. However, these defences can have flaws, known as latent conditions. For an accident to take place, latent conditions must exist in each defensive layer followed finally by an unsafe act by an individual. For instance, increased workload set by management is a latent condition which increases time pressure on employees. This time pressure produces an environment that is susceptible to unsafe acts by employees (Bentley et al., 2005; Reason, 2000). Unsafe acts can be slips, lapses, mistakes, and procedural violations that can have instant and negative repercussions given particular conditions exist (Reason, 2000). Employees that communicate about identified hazards allow for their systematic removal, as the defensive flaws throughout the organisation can be corrected to ensure the hazardous environment is not produced again.

If an organisational system contains latent conditions, an accident will only arise if an unsafe act occurs. Reason's (2000) model suggests that employees are the final defence against accidents, as their safety behaviour decides whether an accident will occur. Ramsey's (1989) theories extend this idea by suggesting that an individual can only act in a safe way if they have particular capabilities to do so. Ramsey's (1989) Accident Sequence model suggests that individuals go through a mental process when they come into contact with a potential

hazard. For an individual to produce safe behaviour they must initially recognise the hazard and then classify it as dangerous. The individual must then decide to avoid the hazard. Finally, they must be able to actively avoid the hazard. For instance, if an individual's heater starts to spark they must first see the heater, recognise that it may start a fire, decide to turn it off, then turn it off and get it fixed. If the individual cannot perform one of these steps, the heater may cause a fire. If the individual can complete these steps then they have the opportunity to respond to the hazard in a safe manner, either through neutralising or reporting the hazard. Failure of an individual to perform any step in Ramsey's accident sequence model will generate an unsafe act and increase the likelihood of an accident.

Situational Awareness

A key phase of Ramsey's (1989) accident sequence model to produce safe behaviour is the ability to recognise hazards, however, this is impossible without situational awareness. Endsley (1995) proposed a model of situational awareness that explains the process of being situationally aware. The steps involve perceiving important parts of the surrounding environment, and assimilating this information to develop a complete understanding of current circumstances. This information is then used to anticipate potential changes in the environment. Previous research on situational awareness has identified that it is a crucial ability in identifying hazards to prevent accidents. Jones and Endsley (1996) found that of aircraft accidents, 71% were due to an error by the aircrew or air control. Of these accidents caused by human error, 76.3% were due to poor situational awareness, in particular, the failure of an individual to perceive the situation. As this has an established influence on accident outcomes, situational awareness will be an important control variable in this study due to it being a necessary step in hazard identification.

Safety Consciousness

Situational awareness attends to the perception and mental processing of one's environment. Safety consciousness is similar in the sense it attends to the perception of one's surroundings, but it also attends to one's desire to respond and behave safely. Westaby and Lee (2003) define safety consciousness as "a positive attitude and awareness toward acting safely in general . . . applicable across work and non-work domains" (p. 298). People that are more safety conscious will implement additional safeguards, such as safety behaviour, that will ultimately reduce injury (Cui, Fan, Fu, & Zhu, 2013; Westaby & Lee, 2003). Safety consciousness has been related to lower accidents, injuries, and greater participation safety activities (Barling, Loughlin, & Kelloway, 2002; Westaby & Lee, 2003). This reduces the risk of workplace hazards, as individuals that have the desire to act safely will be more inclined to take action to eliminate the hazard through correcting the hazard or safety voicing.

Safety Voice

Safety voicing is one of the core means employees have to reduce or eliminate hazards within their workplace. Hirschman (1970), a pioneer of the voicing literature, suggested that employees can either leave an organisation or communicate their dissatisfaction with organisational conditions. Choosing to communicate about dissatisfactory conditions in the effort to improve them is called voice. The literature on safety voice extends Hirschman's preliminary work on voice, by using communication in a way to improve inadequate safety conditions. Workplace hazards provide organisational conditions that can generate worker safety voice in an employee's attempt to proactively remove the hazard (Tucker, Chmiel, Turner, Hershcovis, & Stride, 2008). Tucker et al. (2008) defined safety voicing as "communication motivated towards changing perceived unsafe working conditions that have implications for individual and organisational health . . . can flow through formal and informal

channels ... and can be directed toward numerous targets” (p.320). Safety voicing can ultimately take many forms and targets; from communicating a safety concern about work conditions to a manager or government official to telling a co-worker when they are working in an unsafe manner. Although research on safety voicing is fairly recent, it has been shown to decrease injuries over time (Tucker & Turner, 2015). Furthermore, and as noted above the Health and Safety at Work Act (2015) posits that employees hold responsibility for the safety of themselves and their co-workers (WorkSafe New Zealand, 2016); so, safety voicing to a co-worker can help generate acknowledgement of risks in their environment and help reduce their chances of a workplace accident.

Another key stream in the voicing literature is that on employee silence. Silence is defined as an individual's purposeful suppression of their thoughts or knowledge (Van Dyne, Ang, & Botero, 2003; Pinder & Harlos, 2001), which is incredibly common in the workplace (Pransky, Snyder, Dembe, & Himmelstein, 1999; Probst, Barbaranelli, & Petitta, 2013; Probst & Estrada, 2009; Webb, Redman, Wilkinson, & Sanson-Fisher, 1989). Probst and Estrada (2010) found that for every accident that was reported within an organisation there were an additional 2.48 accidents not reported. People may remain silent for a myriad of reasons such as poor safety climate (Probst & Estrada, 2009), job insecurity (Probst et al., 2013), to reduce managerial workload (Van Dyne et al. 2003), potential strain on workplace relationships (Bienefeld & Grote, 2012; Brinsfield, 2013; Milliken, Morrison, Hewlin, 2003), managerial attitudes and enforcement behaviours (Probst & Estrada, 2009; Webb et al., 1989), and fear of punishment or blame (Adam & Hartwell, 1977; Bienefeld & Grote, 2012; Van Dyne et al., 2003).

Predictors of Safety Voice

The decision of an employee to voice or remain silent about an unsatisfactory work condition depends on the costs and benefits of voicing their concerns (Detert & Edmondson,

2011). Previous research on voicing has allowed us to discern what variables promote or hinder the safety voicing behaviours of an individual. Social identification, hazard severity, leadership behaviours, psychological safety, and co-worker attitudes are predictors of safety voicing that will be examined in the following sections.

Social identification. Voicing has a focusing effect, often drawing negative attention to the individual challenging the status quo (Hirschman, 1970). This introduces a barrier to individuals wanting to voice. Asch's (1956) classic psychological study proposed that individuals will avoid speaking out in a group and conform with common belief, despite knowing that something may be incorrect, to avoid social identification. Deutsch and Gerard (1955) suggested that individuals are prone to aligning behaviours with individuals that are more knowledgeable about a situation. Safety voicing involves the critique of the conditions set by management, who have greater experience and power (Hirschman, 1970). This will limit voicing and prompt social conformity as individuals chose to avoid confronting management (Burris, 2007; Staw & Boettger, 1990). Milliken et al. (2003) found that employees will actively avoid voicing to management to prevent the development of unfavourable opinions, which could damage their relationship. Ultimately, people are apprehensive to voice to eschew negative social identification.

Hazard severity. On occasions where a hazard is markedly severe and an individual cannot correct the hazard themselves, the cost of social identification will be outweighed by the importance of survival. This will prompt an individual to seek help from those that can eliminate the safety risk (Cortina & Magley, 2003). Hazard severity influences safety voicing and behaviour as a hazard that poses legitimate harm will increase an individual's propensity to voice and act in a safe way (Lu, 2014; Neuwirth, Dunwoody, & Griffin, 2000). Lu (2014) found that individuals were more inclined to voice when a concern was serious or life-threatening, but very few would voice when the safety concern was minor. In an ideal world,

all hazards would be voiced, otherwise, even minor hazards may lead to a severe accident through an additive effect of latent conditions combined with an unsafe act (Reason, 2000). Evans et al. (2006) conducted a study investigating incident reporting within hospitals and found that 51.2% of doctors would not report a minor incident. However, only 41.2% of nurses would not report a minor incident, which indicates that people hold different interpretations of risk and what should be reported. Hazards perceived as greater risk are more likely to have an individual correct or voice a hazard, where low-risk hazards tend to be disregarded.

Leadership behaviour. Leadership behaviour and attitudes shape the importance of voicing amongst employees (Detert & Burris, 2007; Hornstein, 1989; Milliken et al. 2003). The absence of managerial support, such as the reluctance to receive subordinate opinion, hinders employee's motivation to voice (Hornstein, 1989; Ng & Feldman, 2012). Supportive leadership behaviours, such as being interested in what an employee has to say and taking action upon their concerns, demonstrate managerial openness to voicing, which reduces the social risks many employees feel in voicing (Detert & Burris, 2007). Openness is a core leadership behaviour for promoting safety voice amongst employees. Ng and Feldman (2012) conducted a meta-analysis of employee voice and found that a lack of openness to voicing amongst management had a moderate negative correlation of $r = .36$ with employee voicing behaviour. Tucker and Turner (2015) found that there were greater instances of workplace injuries when management chose not to respond to the safety concerns of staff. Leader's safety attitudes and behaviours impact how comfortable employees feel to voice, and shapes subsequent work-place accidents.

Psychological safety. Leader support and openness are crucial in promoting voice, to the extent they encourage employee perceptions of psychological safety (Klass, Olson-Buchanan, & Ward, 2012). Psychological safety is defined by Edmondson (1999) as "a shared belief that a team is safe for interpersonal risk taking" (p. 354). An individual must feel

psychologically safe to voice, by believing that they are not at risk of damaging relationships or personal occupational losses (Detert & Burris, 2007; Edmondson, 1999). Detert and Burris (2007) found that leader openness increased safety voicing behaviour, but this was mediated by perceptions of psychological safety. They found a significant negative correlation of $r = -.27$ between a lack of psychological safety and voicing. Similar effect sizes were found in other studies relating psychological safety and employee voice (Burris, Detert, & Chiaburu, 2008; Detert & Edmondson, 2011). Leadership behaviours can increase employee's feelings of psychological safety, which lowers the employee's sense of risk and increases their propensity to voice.

Managers are considered as the main recipients of safety voice, as they hold position and power to resolve an employee's concerns; however, the co-worker's role may be under-acknowledged by current literature. Cortina and Magley (2003), Near and Miceli (1985), and Lee, Heilman, and Near (2004) define voicing as change-related communication directed towards people within an organisation that have the power to make changes to the undesirable state, such as a supervisor or manager. This means change communication directed at co-workers is not considered voicing as they do not have the resource to make changes. Research has also predominantly attended to top-down voice rather than peer to peer voicing (Tucker et al., 2008). This may undermine the contribution of co-workers in supporting safety-voicing due to their perceived inability to change or influence circumstances.

Co-worker attitudes. Co-workers have an established influence over employee safety, impacting on the discussion of safety based information (Laurence, 2005), risk-taking behaviour (Westaby & Lowe, 2005), participation in safety programs (Goldberg, Dar-El, & Rubin, 1991), safety compliance (Simard & Marchland, 1997) safety behaviour (Choi, Ahn, & Lee, 2016), and injury outcomes (Iverson & Erwin, 1997; Kim, Dutra, & Okechukwu, 2014). Co-workers also impact voicing, often being the first outlet for employee voicing due to their

proximity to the voicing individual. Managers, unlike co-workers, are often physically distant from the work being completed, so to voice, employees must purposefully seek out managers to discuss concerns (Tucker et al., 2008). Co-workers may not only be the first point of safety voicing due to their proximity but also because frontline co-workers are exposed to the same hazards as the voicing employee (Carroll, 1998; Tucker et al., 2008). Voicing to co-workers helps them to perceive the safety risk and provide them with the opportunity to respond in a safe manner (Ramsey, 1989). Co-workers have also been suggested to facilitate voice. Tucker et al. (2008) examined the relationship between safety support and employee safety voice within a bus driver population. They found that the relationship between organisational support for safety and employee safety voice was fully mediated by co-worker support for safety. Co-workers hold a vital role as if they are supportive of safety and have a positive attitude towards voicing then employees are encouraged to safety voice about hazardous work conditions.

Co-worker Attitudes, Friendship, and Safety Voicing

Co-worker attitudes towards safety have a clear influence on the voicing behaviours of their colleagues (Tucker et al., 2008), but what factors influence co-workers to develop this attitude? Burt, Sepie, and McFadden (2008) suggested that these caring safety attitudes are developed through generating strong co-worker relationships. Their analysis, completed with a sample of Forestry and Construction workers, found that a caring attitude towards co-worker safety was positively related to group cohesion and the knowledge the employee had of their co-worker. Further analysis conducted with a sample of road construction and power generation workers uncovered slightly different results with team tenure and personal support towards others generating caring attitudes. The research suggested that time spent within a group/team increased the opportunity for employees to obtain information about their colleagues and develop friendships which in turn influence caring attitudes. Burt et al. (2008) then suggested that the caring attitude that arose from relationships between co-workers would

increase safety voicing and hazard correction, ultimately reducing accidents and near misses. The association between relationship strength (i.e. Friendship) and safety voicing is the fundamental interest of the present investigation.

The present study is the first to investigate the association between relationship strength and safety voicing behaviours, nonetheless, the predicted relationships can be informed by well-established conclusions from social psychology literature. Strangers have a tendency not to assist others, as indicated by the social influence of the Bystander Effect (Latane and Darley, 1968; Latane & Rodin 1969; Levine & Crowthers, 2008; Rutkowski, Gurder, & Romer, 1983). When others are around, people have a tendency to watch emergency situations and not intervene where necessary (Levine & Crowther, 2008). This is observed in Latane and Darley's (1968) classical smoke-filled room study. Participants were brought into a small waiting room to complete a questionnaire. During this time smoke began to seep from a wall vent and accumulate within the room. After noticing the smoke, 75% of participants would leave the room and report the smoke to the experimenter. However, this reporting frequency dropped drastically to 10% when an individual was placed in a room with two non-reacting confederates, and 38% with three naïve participants. When people are placed in ambiguous circumstances, like the conditions of Latane and Darley's (1968) classical smoke-filled room experiment, they are uncertain about how they should respond and will seek guidance by observing the responses of others. If people see someone's inaction, they too will adopt that behaviour and view the unusual event as less serious (Latane & Darley, 1969). The present study will place individuals in an ambiguous environment, where they are exposed to hazards they are not familiar with. Their responses are likely to be impacted by the presence of others, as indicated by the bystander effect.

Latane and Darley (1969) suggested that social influence was a core explanatory factor of the bystander effect. As social influence is a key influence, the cohesiveness between people

impacts the effect itself. Rutkowski et al (1983) defined cohesiveness as established relationships between individuals and found that cohesive groups are more inclined to follow the social norm of helping others that need it. This is supported by Latane and Rodin (1969) experiment, which found that 70% of friend pairs would respond to a lady in distress compared to 40% of stranger pairs. They noted that these two groups responded differently. Although Latane and Rodin did not empirically test it they stated:

When strangers overheard the emergency, they seemed noticeably confused and concerned, attempting to interpret what they heard to decide a course of action. They often glanced furtively to one another apparently anxious to discover the other's reaction yet unwilling to meet eyes and betray their own concern. Friends, on the other hand, seemed better able to convey their concern nonverbally, and often discussed the incident and arrived at a mutual plan of action. (pg.200)

They predicted that friends were more inclined to discuss concerns and decide on a method of response and act upon it, compared to stranger pairs that were likely to seek information from the other partner regarding how to respond but feel socially nervous to do so. These predictions made by Latane and Rodin (1969) will be empirically tested by investigating the difference in voicing behaviours between two groups of participants in dyads with differing levels of relationship strength: Friends versus strangers.

Measuring Safety Voicing

The predominant issue with current safety voicing literature is the lack of objective safety voicing measurement. The majority of voicing literature relies on self-reported data (e.g., Burris, 2012; Detert & Burris, 2007; Ng & Feldman, 2012; Probst & Estrada, 2010; Tucker et al., 2008; Tucker & Turner, 2015; Milliken et al., 2003; Van Dyne & LePine, 1998). Retrieving data using surveys, although easier for collecting large quantities of data at a lower cost, can have its disadvantages. Self-report data can be heavily influenced by biases in how the

participant responds. For instance, self-reported voicing data may be misrepresentative of true levels of voicing due to biases such as acquiescence, behavioural inconsistency, socially desirable responding, and exaggerated responding (Austin, Deary, Gibson, McGregor, & Dent, 1998). This could have contributed to the variability of findings in the voicing literature (Detert & Burris, 2007; Tucker et al., 2008). Behavioural inconsistency, in particular, poses an issue for safety voicing as an individual may report higher levels of safety voicing, but may not implement voicing to the same extent in their working life. Of the studies included in Ng and Feldman's meta-analysis, only 29% of the studies did not use self-report, rather they used supervisor or peer rating of voicing. Even these supervisor and peer ratings may fail to reflect actual voicing as employees may feel as though they are communicating a need for change, but a supervisor or peer may interpret this as a regular discussion (Ng & Feldman, 2012). Therefore, there is a need for research which uses objective measures of safety voicing to overcome the limitations of current measurement.

Hazard Laboratory Research

The Hazard Laboratory at the University of Canterbury has been developed to provide a method of measuring safety voicing objectively from participants in an experimental setting. The hazard laboratory is a room that is configured with artificial hazards, such as a sparking heater and broken glass (See Table 1 for a list of the artificial hazards used in this study). The hazard laboratory provides the opportunity for participants to perform safety voicing and hazard corrective behaviours, enabling the objective measurement of these behaviours.

The hazard laboratory has only featured in two previous studies, one completed by Davies (2016) and the other by Marwick (2017). Davies (2016) examined the link between safety voicing, safety behaviours (i.e. correcting a hazard), and hazard severity. Twenty-seven participants were in two groups: High-risk hazard condition and low-risk hazard condition. In the high-risk condition, of the 12 participants that noticed the hazards, only two participants

reported their concern to the experimenter and one participant corrected a hazard. The low-risk condition also produced similar results as of the 14 participants that noticed the hazards only two voiced and two corrected the hazard. This conflicts with self-report data that suggests that the majority of people who are exposed to a severe hazard will report it (e.g., Lawton & Parker, 2002; Lu, 2014). Marwick (2017) chose to extend Davies' work by trying to elicit greater safety voicing in the hazard laboratory through manipulating psychological safety. Unfortunately, none of the 30 participants reported or corrected the hazards. Based on these two studies, substantially less safety voicing may actually exist in real-world situations than is suggested by the majority of the research in the area, which poses an issue for reducing the high workplace accident rates. Davies and Marwick were unsuccessful in identifying a significant predictor of safety voicing. The present study aims to test if relationship strength is a significant predictor of safety voice as proposed by Burt et al. (2008). Specifically, that when individuals are asked to complete a task in the hazard laboratory, pairs of individuals with high relationship strength will be more likely to voice safety concerns to their study partner, to the experimenter, and to correct more hazards.

The Present Study

The present study to the author's knowledge is the first to empirically test the influence of relationship strength on safety voicing and hazard neutralising behaviours. The hazard laboratory method was employed to generate an objective measurement of these interest behaviours. The independent variable, relationship strength, defined two groups: Friends and Strangers. Dyads that were brought into the hazard laboratory were allocated to a group depending on the relationship tenure between the dyad. Dyads were asked to complete a task within the hazard laboratory, during that time they were exposed to office hazards (See Table 1). As previously discussed, there are multiple targets of safety voicing. The differing targets of voice were measured separately to clarify how the different parties may encourage or

discourage an individual's voicing behaviours. Participants were able to discuss safety concerns with the partner they were completing the study with, this was termed *within-dyad voicing*. Participants were also able to seek out the experimental supervisor to discuss safety concerns with them, this was termed *reporting voice*. Finally, *neutralising safety behaviours* are those that aid in the removal of a hazard; through the participant either correcting the hazard themselves or seeking out the experimenter to correct the hazard.

The research tested three hypotheses:

Hypothesis One. Friend dyads are predicted to demonstrate greater within-dyad voicing than stranger dyads.

Hypothesis Two: Friend dyads are predicted to demonstrate greater reporting voice than stranger dyads.

Hypothesis Three: Friend dyads are predicted to demonstrate greater neutralising safety behaviour than stranger dyads

Methods

Design

The present study used a between-groups quasi-experimental design. Participants' reported level of the independent variable, relationship strength, was the selection criteria for group assignment. Data was collected on relationship tenure and relationship type to ensure correct group assignment. The relationship strength variable had two levels with participants being either in the friend dyad group where participants were required to have known each other for at least six months, or the stranger dyad group where the study was the first point of contact for the pair. Participants were misled to believe that the study was investigating how competition differs between friend and stranger pairs and were asked to complete a buzz wire game to test this. Participants were asked to complete the task within the hazard laboratory.

This room contained artificial hazards (see Table 1) to elicit the dependent variables, safety voicing and neutralizing safety behaviours. Safety voicing had two levels: within-dyad voicing and reporting voice. Within-dyad voicing involved the discussion of safety concerns between a dyad and reporting voice is the discussion of safety concerns with a supervisor. Neutralising safety behaviour was any behaviour considered to neutralize a hazard, may it be through hazard correction by the individual or seeking the supervisor to correct the hazard. The study received approval from the University of Canterbury Ethics Committee.

Participants

In total, 106 individuals participated in the present study. Six participants had their data removed as they spoke a non-English language, which posed an obstacle to coding audio data. Of the remaining 100 participants, there were 34 males and 66 females with ages ranging from 17 to 47 ($M = 22.18$, $SD = 5.77$). There was an equal number of participants in each group; with 50 participants in the friend dyad group and 50 participants in the stranger dyad group. The relationship tenure of the participants in the friend condition ranged from 7 months to 138 months ($M = 47.48$, $SD = 36.24$), indicating all participants within this group met the criteria for group allocation. All participants in the stranger dyad condition met the group allocation criteria, as none of the participants within a stranger dyad had met prior to the experiment

Recruitment

Participants were recruited through University noticeboard advertising and the University of Canterbury psychology department participant pool. The research was advertised as a study seeking lone individuals and friend pairs for a study investigating if friendship prompts competition (See Appendix A). The study was advertised on the psychology study participation website, which was accessible by 100-level psychology students at the University of Canterbury. The study utilized haphazard sampling, where people that were willing to

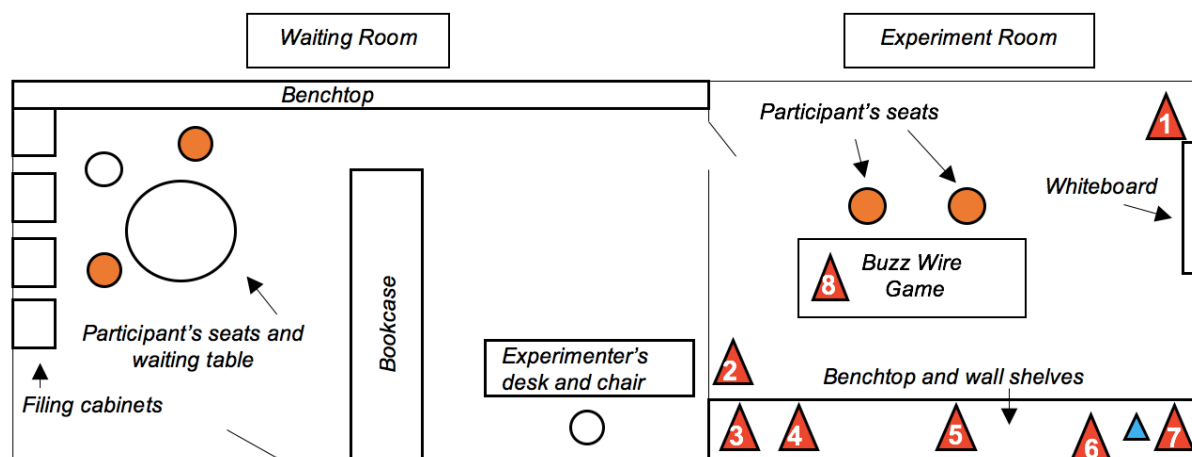
participate were recruited into the study. This sampling method doesn't guarantee that the sample represents the greater population, however, it can produce accurate results given there is no source bias (Weisberg & Bowen, 1977). There was a total of 23 participants recruited through the psychology department participant pool, who received course credit for their 100-level psychology paper as an incentive for participation. The remaining 77 participants were recruited through poster advertising (see Appendix A) on noticeboards around the University of Canterbury or were brought along with another individual that signed up to the study to form a friend dyad. Their participation was incentivized by receiving a \$10 University cafe voucher.

Materials

Experimental stimuli. The experiment was conducted within the hazard laboratory, where artificial hazards were placed around the laboratory as a method for objectively measuring safety voicing and safety behaviours without posing any real threat to the individual's safety. A description and photograph of each artificial hazard is presented in Table 1. Larger images of the hazards are presented in Appendix B. Figure 1 illustrates where the hazards were located within the hazard laboratory, as well as where participants were introduced to the study and where they completed the buzz wire game. The same hazards were used with all participants. Participants were positioned facing the majority of the hazards (see Figure 1) when doing the buzz wire game, participants were also allowed to move around the table to complete the buzz wire task and were asked to write their scores on the whiteboard to maximise movement around the room. The experimenter was not present and left the room for the duration of the buzz wire game so participants could interact freely with their surroundings without the influence of observation.

As the experimenter was not present in the hazard laboratory during the experiment, they could not record within-dyad voicing. To overcome this, a microphone was hidden under the bench in the hazard laboratory to obtain a recording of within-dyad voicing without the

influence of supervisory observation. The position of the microphone within the Hazard Laboratory is presented in Figure 1. The microphone was set to record before participants entered the hazard laboratory, and was collected after participants completed the study. Covert measurement of safety voicing between participants was used to reflect the real-world conditions co-workers experience, where they are often in hazardous environments without supervision.



A red triangle denotes a hazard. Hazard 1 is broken glass, hazard 2 is a sparking heater, hazard 3 is a multi-plug near water, hazard 4 was a microwave containing a metal bowl, hazard 5 is a smoke alarm with its battery lying next to it, hazard 6 is chemical bottles on a shelf that looks likely to fall, hazard 7 is a lamp with exposed wires, and hazard 8 was the exposed wire on the handle of the Buzz Wire game. The blue triangle indicates the location of the microphone. Orange circles denote participant seating areas during the study process.

Figure 1. Illustration detailing hazard laboratory layout and placement of hazards within the experiment room.

Table 1. *Artificial Hazard Descriptions*

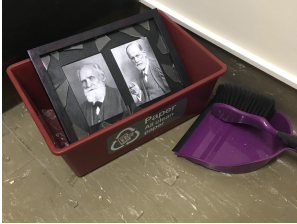


Hazard	Hazard description and location	Why the hazard posed no threat	Corrective actions
<p>1. Broken Glass</p> 	<p>A picture-frame with damaged glass was in a recycling bin on the floor. Some broken glass was also left on the floor around the bin, which would be under the foot of the participants as they moved about the room.</p>	<p>The glass was realistic looking plastic, that would not pierce or shatter causing no threat to participants</p>	<p>Participants could use the brush and shovel next to the bin to place glass into the recycling bin</p>
<p>2. Faulty Heater</p> 	<p>A fan heater was placed on the floor and would appear to be sparking and the sound of electrical arcing would play when activated by the experimenter.</p>	<p>The heater itself did not work. Rather a 9-volt battery powered the heater light to make the heater appear to be on. The battery also powered LED lights that would flash to create a “sparking” effect which would activate in conjunction with a recorded electrical arcing sound bite.</p>	<p>The heater could be turned off at the heater’s power switch or turned off at the electrical socket on the wall.</p>
<p>3. Water near a multi-plug</p> 	<p>A jug was plugged into a multi-plug next to the microwave. The multi-plug was sitting in a small pool of water that appears to be from the jug. This would appear to be both a fire and electrocution risk.</p>	<p>Similar to the heater, the multi-plug didn’t work. A small 9-volt battery powered the small power light on the multi-plug, so it appeared to be on. No electricity was passing through the outlet points on the multi-plug.</p>	<p>Participants could remove the hazard by turning the power to the multi-plug off at the wall socket and/or dry the spill with a nearby cloth</p>

Table 1. *Artificial Hazard Descriptions Continued*






Hazard	Hazard description and location	Why the hazard posed no threat	Corrective actions
<p>4. Metal bowl in Microwave</p> 	<p>The microwave contained a metal bowl which would create a fire risk if the microwave was in use.</p>	<p>The microwave had its magnetron removed, so although it appeared to work as a normal microwave, it wouldn't produce radiation which would generate sparks when combined with metal.</p>	<p>Participants could remove the metal bowl from the microwave</p>
<p>5. Smoke alarm without battery</p> 	<p>A smoke alarm with its battery removed was placed on the bookshelf at eye level, rather than the ceiling. This poses risk, as in the case of a fire the smoke-alarm would not alert individuals in the room to the fire hazard.</p>	<p>The University has a hard-wired smoke alarm and detection system, which would have alerted participants without the need of the present alarm.</p>	<p>Participants could replace the battery into the alarm</p>
<p>6. Falling chemical bottle</p> 	<p>Various chemical bottles were stored on the shelves above the bench. A bottle of Acetone appeared to be sitting precariously on the edge of the shelf, about to fall.</p>	<p>The chemical bottles were only displays, containing water and secured to the shelf. The Acetone bottle also contained water and was attached to a plastic arm that would stop it from falling off the shelf.</p>	<p>Participants could push the Acetone bottle backwards so it was sitting on the shelf in a safe position.</p>

Table 1. *Artificial Hazard Descriptions Continued*

Hazard	Hazard description and location	Why the hazard posed no threat	Corrective actions
<p>7. Lamp with exposed wiring</p> 	<p>The lamp was sitting on the benchtop close to the whiteboard. It was turned on at the lamp's switch and the wall socket it was plugged into. The lamp's wires were exposed and damaged creating a fire and electrocution risk.</p>	<p>The lamp was connected to a fake electrical outlet on the wall, so no electricity was reaching the lamp.</p>	<p>Participants could turn off the lamp at its switch or at the wall socket.</p>
<p>8. Exposed wire on wand handle of the buzz wire game (H8)</p> 	<p>The handle was attached to the buzz wire game in the middle of the room. Participants would use the wand as part of the task. There were exposed and damage wires where the handle had appeared to be previously repaired, which creates a risk of an electric shock.</p>	<p>The handle was powered but the “exposed wire” was placed on the outside of the real insulated wire of the handle. This meant the exposed wire had no connection to electricity and posed no electric shock risk</p>	<p>Electrical tape and scissors were left on the benchtop, so participants could repair the damaged wire.</p>

Buzz wire game task. Participants completed a buzz wire game task (See Figure 2), where the aim was to guide a metal wand with a loop over a complicated wire without touching the wire itself. A small red light attached indicated if the participant made contact between the wand and the wire, this was considered to be an error. Error data was recorded manually by the participant not completing the task, using a hand-held clicker counter. The task and its error data was not used for any measure in the study but was used to hide the study's true aims and provide a task that allowed the participants to remain in the hazard laboratory for approximately thirty minutes. The game was placed on a table in the centre of the hazard laboratory (see Figure 1), with participants seated facing the majority of hazards (See Appendix C).



Figure 2. Photograph of the buzz wire game used in the hazard laboratory

Measures

Group allocation and demographic information. At the point of recruitment, participants indicated if they were going to participate with a stranger or a friend. To ensure the dyads met the criteria for group allocation, participants were asked to indicate relationship tenure and type (See Appendix D) with the individual they participated with in the study following the completion of the buzz wire game. To measure relationship type, participants were asked: “What is the nature of the relationship you have with the participant you worked with today”. Participants could respond by selecting an answer from “Family”, “Friend”, “Romantic Partner”, “Stranger”, or indicate another relationship type through their own specification. “How long have you known the participant you worked with?” was used to measure relationship tenure, where responses were gathered in months and years. The same post-experimental questionnaire also asked participants to provide their *age* and *gender*.

Situational awareness. A quantitative analysis of situational awareness (QUASA) was employed as the method of assessing situational awareness differences between groups. The QUASA combines self-ratings (confidence scores) and objective measurement (true/false probes), providing a comprehensive measure of situational awareness. Following recommendations from McGuinness (2004), the 10-item scale developed by Marwick (2017) contained true/false probes, where participants were presented with descriptions of the hazard laboratory environment and asked to indicate if each statement was true or false. Of the ten items, there were five true and five false statements. “There were two fire extinguishers in the room” and “There was a candle in the room” are example items from the scale. The full scale is presented in Appendix D. A situational awareness score was calculated for each participant, by totalling the number of correct answers participants gave in response to the true and false statements. A larger situational awareness score was interpreted as the participant having greater situational awareness within the hazard laboratory. Participant’s confidence ratings for

responses to the true/false statements were collected using a five-point scale, ranging from “Very High” (5) to “Very Low” (1). These confidence ratings produced an overall situational awareness confidence score for each participant by summing confidence ratings and dividing the total by the number of items. Higher situational awareness confidence scores indicated greater self-perceived accuracy in the responses given by the participant.

Safety consciousness. Participants completed the seven-item Safety Consciousness scale developed by Westaby and Lee’s (2003). Sample items used to measure safety consciousness include “I always take extra time to do things safely” and “Doing the safest possible thing is always the best thing”. A complete version of the scale is presented in Appendix D. Responses for each item were on a 5-point scale, which ranged from strongly disagree (1) to strongly agree (5). Scores were calculated by summing the participant’s item ratings and dividing this score by the number of items. Higher scores on this scale indicated greater safety consciousness of the participant.

Dependent variable. The experimental stimuli (the artificial hazards) permitted the measurement of safety voicing to the experimenter and between participants, and hazard neutralising behaviours. A reporting voice and corrective behaviour scoring sheet was developed (see Appendix E) to be completed by the experimenter during and immediately after the experiment. This measurement system was used as a measure of reporting voice and corrective behaviours (as defined in Table 1), by recording what hazards had been reported to the supervisor, who reported it, when they reported it, if the hazard was corrected and if so, by whom. A participant was considered to demonstrate reporting voice if they sought out the experimenter during the time they were completing the buzz wire task to inform them about a hazard within the hazard laboratory. Once participants commenced the questionnaire (See Appendix D) reports were not recorded, as the safety-related content of the questionnaire may have prompted the report of hazards.

A second scoring sheet was used for within-dyad voicing to be completed with the audio data collected via the microphone hidden in the hazard laboratory (See Figure 1). This measurement system (See Appendix E) was used to code the audio data collected to generate a record of within-dyad voicing; specifically, which participant initiated the safety voicing discussion by acknowledging a hazard, time into the experiment that this discussion was initiated, the number of words incorporated in the discussion between the dyad, and if the discussion was conversational or a statement. To illustrate how the coding was conducted, two examples of within-dyad voicing from audio files are provided below:

Example One:

Participant 1: Do you think the heater should be doing that?

Participant 2: I don't know.

Participant 1: Should we turn it off at the wall?

Participant 2: Do you want to stop and ask or should I ask?

Participant 1: Yes, in case we accidentally turn off the game

Example Two:

Participant 1: "What is that? The fan heater?"

Participant 2: "Yeah, it's buzzing"

In both examples, participant 1 initiated the discussion about the heater hazard, as they were first to verbally acknowledge the hazard to the other participant. The time into the experiment is indicated by the length of time participants spent within the hazard laboratory before one of the participants initiated the discussion about a particular hazard. The total number of words used in the discussion of the heater hazard is 40 and 9 for example one and example two respectively, this is used to indicate the magnitude of the discussion about the hazard. The discussion type was distinguished by statement or conversation. Example one illustrates a conversational discussion type as the exchange involves feedback, negotiation, and mutual

problem solving of how to respond to a given hazard (Kent & Taylor, 1998). Example two illustrates a statement discussion type, where the hazard discussion is limited to just the verbal acknowledgement by a participant. Statement discussions can also involve feedback from the other participant, but this must be limited to a response in acknowledgement of their statement, as provided by participant 2 in example 2. Employing this method of within-dyad coding ensured a thorough objective measurement of safety voicing, which is missing in current safety voicing literature that typically utilises self-report measures.

Procedure

At the point of recruitment, participants received an email detailing that the purpose of the study was to test competition amongst friends, to mislead participants as a method of reducing bias in the data. The email was also used to organise a time that participants could come to the laboratory to participate in the research with another participant; either a friend if they have indicated who they would like to participate with in the study or a stranger.

When participants arrived at the hazard laboratory to participate, they were welcomed by the experimenter and invited to sit down in the waiting room until the other participant arrived. Once both participants had arrived, the experimenter introduced themselves and the study and provided the participants with an information sheet (See Appendix F), a consent form (See Appendix G), and participant codes for de-identifying the data they provided as per requirements of the University of Canterbury Human Ethics Committee. All participants completed a consent form (See Appendix G) where they provided consent to participate in the study before the experiment. Participation was voluntary and participants were allowed to withdraw during and after the experiment. The information sheet provided contained misleading information about the study, however, participants were fully debriefed at the completion of the study. As deception was used, post-debrief consent was also gained from all participants. This post-debrief consent agreed to allow the use of their covert audio recording

for data analysis and for the data to be used in light of the clarified hypotheses.

Once participants completed the consent forms, they were brought into the hazard laboratory by the experimenter and introduced to the buzz wire game. This task was used to mislead participants into believing the research was investigating competition between friends and strangers. Participants were asked to take a seat and were instructed as to the rules and requirements of completing the buzz wire game. They were instructed that the aim of the game was to guide the wand over the wire from start to finish touching the wire track as little as possible. If they did touch the wire, a small red light would appear and that would count as an “error”. They were also instructed that as one participant completed a trial of the game, the other participant would use a hand clicker counter to count the number of errors the participant playing the game made. Participants were asked to complete five trials of the buzz wire game each, they were asked to write up the error scores on the whiteboard in the hazard laboratory after each trial. This promoted increased movement around the hazard laboratory and time spent completing the task. Participants were instructed that they could use any technique they wanted and could move around the table but were not allowed to drag the wand along the wire and count it as a singular error.

Before the participants were left together to complete the trials, the experimenter asked the participants to read out their participant codes so they could be written on the whiteboard. This permitted an audio record of who the participants were so *within-dyad voicing* audio data could be matched to written data (ie. Questionnaires and scoresheets). Participants were finally asked if they had any questions and if they needed anything to come and see the experimenter at the table in the waiting room (See Figure 1). Once this was told to the participants, the experimenter left the room and closed the inter-leading door between the hazard laboratory and the waiting room.

Participants were left in the hazard laboratory and spent an average of 26.6 minutes

($SD = 6.65$) completing the trials of the buzz wire game. Ten minutes after participants had been left in the hazard laboratory, the experimenter activated an audio recording of electrical arcing which would play through the heater in the hazard laboratory in conjunction with LED lights to make the heater appear as though it was sparking. The audio recording of the electrical arcing lasted 44 seconds. During the participant's time in the laboratory, they could seek out report a hazard to the experimenter. If this happened, the experimenter would thank the participant for letting them know and immediately correct the hazard voiced by the participant. For instance, if a participant told the experimenter that the heater appeared to be sparking, the experimenter would turn off and remove the heater from the laboratory. The experimenter would then record the voicing behaviour on the reporting voice and neutralising behaviour scoring sheet (See Appendix E).

After participants completed the buzz wire game trials they were asked to complete a post-experimental questionnaire (See Appendix D), consisting of the safety consciousness scale items, situational awareness questions, demographic questions, and group allocation questions. While this was being completed, the experimenter entered the laboratory to collect the audio recording and to record corrective behaviours on the scoring sheet (See Appendix E). Once participants completed the questionnaire, they were debriefed by the experimenter as to the true aims of the study and deception regarding the covert audio recording. Participants were reminded that they could withdraw their data at this point and until data collection ceased. They were then provided with a written debrief and were asked to provide post-debrief consent (See Appendix H) which permitted the use of the audio recording and data for the true study aims. Participants were asked to keep the nature of the experiment confidential, as to prevent bias from subsequent participants knowing the purpose of the study before debriefing. Finally, participants were given their incentive and thanked for their participation.

Results

Descriptive Statistics and Manipulation Check

Manipulation check. To determine if group allocation was successful, participants were asked to indicate the nature of their relationship with the individual they participated with, and the duration of time they had known each other pre-experiment. Table 2 shows the results. Inspection of the table indicates that all participants met the criteria set by the study, with all participants in the stranger group meeting their study partner for the first time at the experiment. All participants in the friend group had known their study partner for at least 6 months and were either friends or romantic partners.

Group Equivalence. Before examining the study hypotheses, participant characteristics and potential control variables were calculated and compared in light of the lack of random assignment into the groups, to ensure the friend dyad and stranger dyad groups were equivalent. The descriptive statistics of the demographic variables for each group, including means and standard deviations are presented in Table 2. Mann-Whitney U tests were performed to compare the two groups, to check if they differ significantly on any of the demographic variables. Age was the only demographic variable found to be significantly different ($U = 1668, p = 0.004$) between the two groups, where participants in the friend group were younger than participants in the stranger group. Due to the friend group being significantly younger than the participants in the stranger group, age was controlled for when testing the study hypotheses.

Table 2

Demographic Information of Participants by Group

	Friend Group (N = 50)	Stranger Group (N = 50)
Gender		
Males	20	14
Females	30	36
Age		
Mean (SD)	20.6 (3.1)	23.7 (7.2)
Relationship Tenure (Months)		
Mean (SD)	47.4 (36.2)	0 (0)
Range	7 - 138	0
Relationship Type (N)		
Friend	40	-
Romantic Partner	10	-

Safety consciousness (Westaby & Lee, 2003) and situational awareness (Endsley, 1995) are crucial predictors in the performance of safety behaviours and willingness to voice, which makes them important control variables to consider and see if there are significant differences between the groups on these variables. Table 3 presents the mean and standard deviation from the safety consciousness, situational awareness, and situational awareness confidence measures of participants in each group. Mann-Whitney U tests were conducted to compare the friend and stranger groups on these variables. Results are shown in Table 3. Inspection of Table 3 indicates that safety consciousness and situational awareness confidence did not differ significantly between the groups, and therefore will not be required to be taken into consideration with further analyses.

Table 3

Mean and Standard Deviations of Control Variables by Groups

	Friend Groups (N = 50)	Stranger Groups (N = 50)	Mann-Whitney U test
Safety Consciousness			
Mean (SD)	3.3 (.65)	3.1 (.72)	NS
Situational Awareness Score			
Mean (SD)	6.4 (1.4)	5.6 (1.2)	U=918, $p = .019$
Situational Awareness Confidence			
Mean (SD)	3.14 (.52)	3.09 (.68)	NS

In contrast, there was a significant difference between groups on the situational awareness variable, with participants in the friend group demonstrating greater situational awareness. As such this variable and the age variable were controlled for when testing the study hypotheses. Controlling for age and situational awareness in further analysis allows the groups to become equivalent in terms of the personal characteristics that may influence the independent variables, allowing for an accurate assessment of the relationship strength variable.

There were no non-parametric tests that would allow the hypotheses to be tested whilst controlling for the age and situational awareness variables. Therefore, the ANCOVA procedure was employed to test the hypotheses. An assumption of ANCOVA is that the groups used in the analysis are randomly generated and independent. Random assignment is used to generate groups of participants with similar characteristics, so by controlling for age and situational awareness the analysis is achieving the same goal of random assignment by creating equivalent groups.

Hypothesis Testing

Hypothesis One: Friend dyads are predicted to demonstrate greater within-dyad voicing than stranger dyads.

The first variable of interest is within-dyad safety voicing. Table 4 presents the overall initiation score for within-dyad voicing by group. The within-dyad safety voicing initiation score was generated by totalling the number of times a participant initiated safety voicing about a distinct hazard within the hazard laboratory. There were eight hazards that could be voiced (See Table 1). The observed ranges for each group were 0 to 3 and 0 to 1, for the friend group and stranger group respectively, where zero indicated no instance of initiated within-dyad voice. The corrected means for the within-dyad initiation score were generated from averaging how many instances of within-dyad safety voicing were initiated across each group, while controlling for age and situational awareness. As over half of the participants in both conditions did not within-dyad safety voice and received a zero for their initiation score, the corrected mean was below one. An ANCOVA test was performed to examine if there was a significant difference between participants in friend dyads and stranger dyads in regard to the within-dyad voicing initiation score. After controlling for age and situational awareness, there was a significant difference ($F(1,96)=5.45, p=.022$) between groups in the initiation of within-dyad safety voicing. This supports hypothesis one, indicating that individuals partnered with a friend voiced more hazards within the hazard laboratory than stranger dyads.

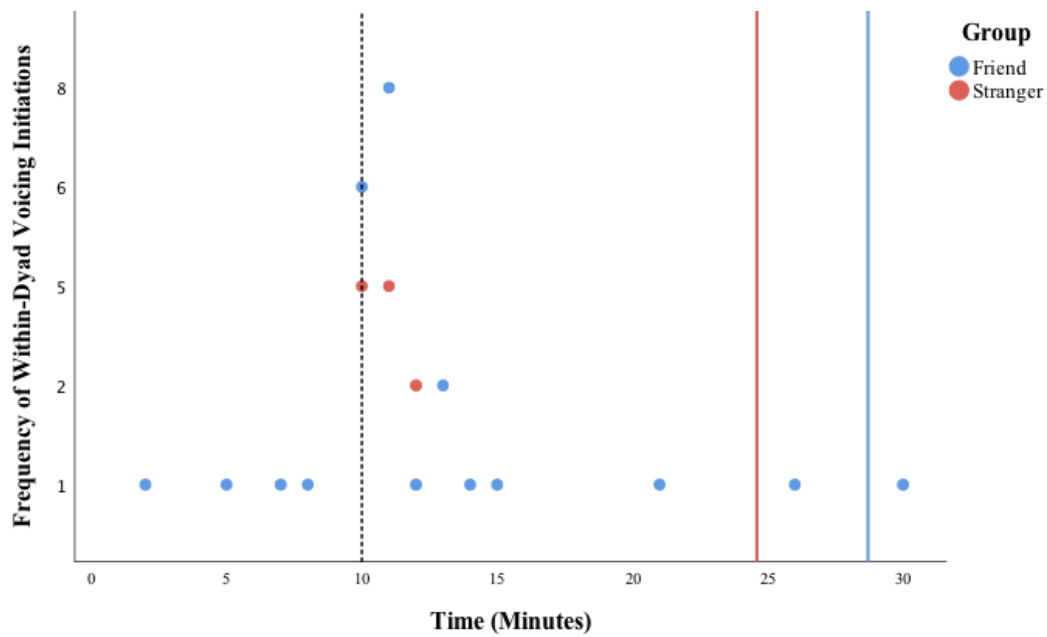
Table 4

Corrected Mean and Standard Error of Initiation Scores for Within-Dyad Safety Voicing

	Friend Group (N = 50)	Stranger Group (N = 50)
Corrected Mean (SE)	.537 (.086)	.243 (.086)

Note: Covariates appearing in the model are evaluated at the following values: situational awareness = 6.03 and age = 22.18.

Time distribution of within-dyad voicing. The time it took to complete the buzz wire game was flexible, where participants were allowed to take the time they required to complete the task. This ensured that imposed time pressures did not prevent participants from voicing or behaving safely. The friend dyad group spent slightly longer in the hazard laboratory, spending an average of 28.7 minutes ($SD=7.1$) in the laboratory, compared to stranger dyads, who spent an average of 24.6 minutes ($SD=5.4$) in the laboratory. Figure 3 presents the frequency of *within-dyad voicing* initiations for each group relative to time spent in the hazard laboratory. The diagram demonstrates that the majority of voicing instances occurred within the first 15 minutes, concentrated around the ten-minute mark when the heater sparking and electrical arcing occurs. Only two instances of voicing occurred after the mean time spent in the hazard laboratory by the stranger group elapses. It is also evident by the frequency of blue dots in Figure that the friend group was voicing more – providing further support for hypothesis 1.



The dashed black line presents the time the sparking heater hazard was activated. The red and blue lines indicate the average time spent in the hazard laboratory for each group.

Figure 3. Frequency of *Within-Dyad Voicing* Initiations against time spent in the Hazard Laboratory

The magnitude of within-dyad voice. To further investigate the nature of the within-dyad safety voicing, the magnitude of within-dyad voicing and discussion type were analysed. The magnitude of the within-dyad safety voicing was quantified by totalling the number of words used by participants when discussing each hazard. The corrected mean and standard error of the voicing magnitude scores by hazard and group are presented in Table 5. An ANCOVA test, again controlling for age and situational awareness, was performed to test if there was a significant difference between groups in regard to the number of words used by the participants to discuss the hazards. In support of hypothesis 1, a significant difference was found between groups in the overall magnitude of within-dyad voicing ($F(1,96)=3.94, p=.05$), with friend dyads using more words whilst voicing safety concerns compared to stranger dyads.

Table 5

The Mean Number of Words Used in Within-Dyad Safety Voicing Instances by Group

	Friend Group (N =50)	Stranger Group (N = 50)
Corrected Mean (SE)	11.662 (2.316)	4.938 (2.316)

***Note:** Covariates appearing in the model are evaluated at the following values: situational awareness = 6.03 and age= 22.18.*

Discussion Type. The type of discussion about hazards used was also investigated, to delineate how the exchange of within-dyad safety voice communications occurred. Discussion type was distinguished with each instance of voicing to identify if the dyad demonstrated conversational discussion where a participant would provide information about a hazard, then receive feedback from the other dyad member acknowledging the information they provided, followed by further discussion and negotiation about how to respond to the hazard. This was contrasted to a statement, where a dyad member may voice a safety concern but this is limited to simply passing information onto the other dyad member, such as informing or commanding. The data for this was coded using the scoring sheet present in Appendix E.

The frequency of conversation and statement discussions types during within-dyad safety voicing by group for each hazard are presented in Table 6. The proportion of statements regarding the chemical bottles by friend dyads was significantly greater than the proportion of statements by the stranger group ($Z=2.357$, $p<.05$), as indicated by a test of binomial proportions. However, the difference in statement proportions between groups was not significant for the overall statement discussion types measure.

Another test of binomial proportions was conducted to analyse if there was a significant difference between groups in the proportion of conversational discussion type across all

hazards within the hazard laboratory (See overall frequency of conversations in Table 6). Results indicated that friend dyads demonstrated a significantly greater proportion of conversation based hazard discussions than the stranger group ($Z=2.193, p<.01$). This suggests that although the groups may not differ depending on the proportion of statements they provide during within-dyad voicing, they do differ in regard to the proportion of conversations regarding safety concerns. Indicating that dyads with greater relationship strength have more conversation based discussions regarding hazards than those that are strangers.

Table 6

Frequency of Conversations and Statements used in Within-Dyad Voicing by Group

Hazard	Friend Group (N = 25)		Stranger Group (N = 25)	
	Conversation	Statement	Conversation	Statement
Broken Glass	1	1	0	0
Heater	11	4	6	6
Water Multi-plug	1	0	0	0
Microwave	0	1	0	0
Smoke Alarm	0	0	0	0
Chemical Bottles	2	5	0	0
Lamp - Wire	1	0	0	0
Handle - Wire	0	0	0	0
Overall	16	11	6	6

Hypothesis Two: Friend dyads are predicted to demonstrate greater reporting voice than stranger dyads.

The second variable of interest was reporting voice, which was the propensity of participants to voice safety concerns to the experimenter/supervisor. The reporting voice score was generated by totalling how many instances of safety voicing to the experimenter was initiated by a participant, out of eight hazards to report (See Table 1). The observed ranges for both groups were 0 to 1 instances of reporting, with zero indicating no reporting voice. Table 7 presents the corrected mean (after controlling for age and situational awareness) and standard error of participant's reporting voice initiations by group. Similar to within-dyad voicing, the corrected means are below one, as these values are averaged across the group, where a large proportion of participants chose not to report and received a zero for their initiation score. An ANCOVA test was performed controlling for age and situational awareness score and found no significant difference between groups in the initiation of reporting.

Table 7

Corrected Mean and Standard Error of Initiation Scores for Reporting Voice

	Friend Group (N = 50)	Stranger Group (N = 50)
Corrected Mean (SE)	.086 (.037)	.054 (.037)

Note: Covariates appearing in the model are evaluated at the following values: age=22.18 and situational awareness = 6.03.

While it is clear from Table 7 that the overall frequency of reporting voicing was very low, the frequency was examined for each hazard. The frequency of reporting by hazard is presented in Table 8. To further test the hypothesis that friend dyads are predicted to demonstrate greater reporting voice than stranger dyads, a test of binomial proportions was calculated for the heater hazard. No other tests of binomial proportions were conducted as no

other hazard was reported. The test produced no significant difference in the proportion of each group engaging in reporting voice.

Table 8

Reporting Voice of Artificial Hazards by Group

Artificial Hazard	Friend Group (N = 50)	Stranger Group (N = 50)
Broken Glass	0	0
Heater	5	2
Water Multi-plug	0	0
Microwave	0	0
Smoke Alarm	0	0
Chemical Bottles	0	0
Lamp - Wire	0	0
Handle - Wire	0	0
Overall	5	2

Hypothesis Three: Friend dyads are predicted to demonstrate greater neutralising safety behaviours than stranger dyads.

The third variable of interest was the neutralizing safety behaviours. The overall score of neutralising safety behaviours was generated by totalling how many instances participants corrected a hazard in the hazard laboratory or sought the experimenter to correct a hazard. When participants demonstrated reporting voice, the experimenter would always respond to this by correcting the hazard. This is because supervisors that address the safety concerns of an individual increases their propensity to voice again (Detert & Burris, 2007; Ng & Feldman, 2012; Tucker et al., 2008). It was necessary to pool the data of participants and the experimenter completing the correction, as it was unclear if participants would have corrected the hazard if the experimenter had not intervened. Seeking the supervisor to correct the hazard and correcting the hazard yourself produces the same outcomes of neutralising the hazard, so both

are considered to be neutralising behaviour. There were eight hazards that could be neutralised (See Table 1). Table 9 presents the corrected mean and standard error of neutralising safety behaviour by group. The observed neutralising behaviour scores ranged from 0 to 3 and 0 to 1, for the friend group and stranger group respectively, with a zero indicating no hazard neutralising behaviour. A large proportion of participants in both groups chose not to neutralise any hazards. As a result, the corrected mean is below zero as these were calculated by averaging across participants that did and did not neutralise hazards within each group. An ANCOVA test was performed, controlling for age and situational awareness, which demonstrated no significant difference between groups in the initiation of neutralising safety behaviours.

Table 9

Corrected Mean and Standard Error of Neutralising Behaviour by Group

	Friend Group (N = 25)	Stranger Group (N = 25)
Corrected Mean (SE)	.165 (.062)	.115 (.062)

Note: Covariates appearing in the model are evaluated at the following values: age=22.18 and situational awareness = 6.03.

The frequency of hazard correction and by whom for each hazard is presented in Table 10. Tests of binomial proportion were used compare the proportion of neutralising behaviours between groups; including a test comparing participant based corrections, experimenter based corrections, and overall corrections. No significant difference between groups was found. Therefore, hypothesis three was not supported.

Table 10

Frequency of Hazard Correction by Participant and Experimenter

Artificial Hazard	Friend Group			Stranger Group		
	(N=25)			(N=25)		
	Corrected	Participant	Experimenter	Corrected	Participant	Experimenter
Broken Glass	0	0	0	0	0	0
Heater	7	3	4	5	3	2
Water Multi-plug	1	1	0	0	0	0
Microwave	0	0	0	0	0	0
Smoke Alarm	0	0	0	0	0	0
Chemical Bottles	0	0	0	0	0	0
Lamp - Wire	1	1	0	0	0	0
Handle - Wire	0	0	0	0	0	0
Overall	9	5	4	5	3	2

Discussion

The aim of the current study was to investigate the influence of relationship strength on within-dyad voice, reporting voice, and hazard neutralising behaviours. The research was conducted to test three hypotheses analysing the relationship between these variables. These hypotheses proposed that friend dyads would demonstrate greater within-dyad voicing, reporting voice, and hazard neutralising behaviours due to their greater relationship strength. The present study is amongst the few studies to objectively measure and analyse voicing under experimental conditions and is perhaps the first to measure within-dyad voicing in this manner.

Relationship strength was positively related to within-dyad voicing, where friend dyads voiced their safety concerns to each other more than stranger dyads. Of 100 participants, 22 friend group participants initiated within-dyad voicing at least once, compared to 12 in the stranger group. This finding is consistent with Burt et al.'s (2008) prediction "that teams with a strong caring climate should . . . actively communicate safety issues more frequently" (pg.89). Caring teams in this study were those with longer relationship tenures, as this was a key indicator of a strong caring relationship in Burt et al.'s (2008) study. Individuals that have a stronger relationship with the individual they are completing a task discuss safety concerns more with the other individual than if the person they were working with was a stranger.

During instances of within-dyad voicing, friend dyads used significantly more words in their discussion of safety concerns and demonstrated significantly greater instances of conversational discussion about the hazards than stranger dyads. These findings taken together indicate that dyads with greater relationship strength have more detailed discussions, which are more likely to involve feedback and mutual problem solving of how to respond to a given hazard (Kent, & Taylor, 1998). All instances of reporting voice for both groups were preceded by conversational discussion during within-dyad voicing, which suggests this may promote

reporting voice. However, this could not be statistically tested due to the low proportions of reporting voice.

Unlike within-dyad voicing, there was no significant difference between stranger and friend dyads in the propensity to report safety concerns. There was a strikingly low proportion of participants reporting, even with within-dyad voicing. The heater hazard was the only hazard reported to the supervisor in both groups. Of the 100 participants that completed the study, only five participants in the friend group and two in the stranger group reported the hazard. The low proportion of reporting voicing was no surprise as previous research utilising the same objective method of measurement also uncovered low proportions of reporting voice. Davies (2016) found that only four out of 54 participants chose to report a hazard to the supervisor, and Marwick (2017) found no hazard reporting at all in 30 participants. Both authors commented on how these findings do not reflect the conclusions made by previous research, which indicate that people would safety voice if they came into contact with a hazard (Evans et al., 2006; Lawton & Parker, 2002; Lu, 2014; Tucker & Turner, 2014).

Neutralising safety behaviour was also markedly low, with only 14 instances of hazard corrections across both groups. Only eight of the hazard corrections were completed by the participant themselves, and six hazard corrections were completed by the experimenter following reporting voice by a participant. Due to the low proportion of neutralizing safety behaviours, there was no significant influence of relationship strength. Again, these findings were consistent with conclusions from previous studies objectively measuring safety behaviours. Davies (2016) only had seven participants demonstrate neutralising behaviour, and no participants demonstrated these behaviours in Marwick's (2017) study. Again, this was inconsistent with conclusions from past research that determined that in general, people would neutralise hazards (Choi et al., 2016). These findings indicate that self-reported intentions may not reflect actual safety behaviours.

There was a large proportion of dyads that demonstrated within-dyad voicing about safety concerns whilst in the hazard laboratory, indicating that difficulty recognising the hazards was not what caused the low proportion of reporting voice and neutralising behaviours. The extremely low proportion of reporting voice and neutralising behaviours can be explained by considering the costs and benefits of adopting these actions within the circumstances of the study. Prior research has demonstrated that people are more inclined to voice or neutralise a hazard if the hazard posed legitimate potential harm to the individual (Lu, 2014; Neuwirth, Dunwoody, & Griffin, 2000). In the present study, only safety concerns about the heater hazard were reported to the experimenter. This heater hazard was rated during a pilot study completed by Davies (2016) as the second most dangerous hazard out of the hazards used in the present study. The majority of the hazards used in the laboratory were deemed less risky and less obvious than the sparking heater hazard. Participants in the present study were perhaps less inclined to report or neutralise these hazard, as they were considered as less severe.

The low proportion of reporting and neutralising behaviours after within-dyad voicing may be due to the behaviour and safety attitudes of the participant's study partner. The bystander effect indicates that people will look at how other people are responding during an ambiguous situation to learn how they should respond themselves and to indicate how serious the instance is (Latane & Darley, 1969). As the hazard laboratory presented an ambiguous environment for the participants, they would be more inclined to seek behavioural cues from their partner in how to respond. The present analysis tested how the strength of the relationship between dyad members impacted how people would respond in the hazard laboratory. The safety consciousness of one's partner may have also impacted their responses; however, this was not empirically tested in the current study. In total, thirty participants initiated within-dyad voicing. Of these, fourteen were partnered with someone with low safety consciousness (scoring below a three). After these fourteen participants voiced their concerns to their partner,

none decided to report and only two decided to correct the hazard themselves. In contrast, of the sixteen participants paired with a partner with high safety consciousness (scores above a three) there was a nearly even split of response to non-response; with nine dyads either demonstrating reporting voice or corrective behaviours after within-dyad voicing and seven dyads not responding to the hazard in anyway after within-dyad voicing. These findings are echoed by Tucker et al. (2008), who found that employees that viewed their co-workers as unsupportive of working safely, similar to low safety consciousness, were less inclined to safety voice. In this study, participants with low safety consciousness are likely to have responded in a passive manner or hold a nonchalant attitude towards the hazards within the laboratory. This may have reduced the concern of the voicing participant through behavioural modelling, further decreasing the likelihood they would report or demonstrate neutralising behaviours.

Theoretical Implications

The present study was predominantly conducted to test the theoretical prediction made by Burt et al. (2008) who suggested that people with stronger relationships, and therefore greater caring relationships, would be more inclined to demonstrate safety communications and remove hazards from their environment. There was only partial support for this prediction, as only safety communications between dyad members were significantly greater with stronger relationships. However, there was no significant difference in safety communications to supervisors and hazard removal depending on relationship strength. As previously indicated, these non-significant findings may be due to the safety behaviour demonstrated by participants within the dyad; where having a strong caring relationship may not be enough to prompt reporting voice or hazard neutralising behaviours if the colleague is disinterested safe behaviour.

The findings of the present study contrast with past findings, as there was a markedly low proportion of reporting voice and neutralising behaviours. This is likely due to the nature of research conducted prior to hazard laboratory studies on safety voicing and behaviours. The majority of prior research on voicing has employed self-report measures to indicate an individual's propensity to reporting voice or demonstrate neutralising behaviours. The findings were typically positive, with people indicating they were likely to demonstrate these behaviours if they came into contact with hazards (See. Choi et al., 2016; Lu, 2014; Tucker et al., 2008; Tucker & Turner, 2015). Findings from self-report measures can be unreliable as they are susceptible to manipulation. Participants may choose to respond in a socially desirable manner by providing higher ratings of their self-perceived safety behaviours, which misrepresents how they actually behave. This behavioural inconsistency issue is overcome with the hazard laboratory technique, as it provides an objective measure of actual safety voicing and neutralising behaviours. Only two studies (See. Davies, 2016; Marwick, 2017) have measured safety voicing and neutralising behaviours objectively, with similar findings to the present study. However, this study is the first to investigate, and subsequently generate a significant difference for within-dyad voicing. Conclusions drawn from self-reported findings from past research on neutralising behaviours and safety voicing should be taken tentatively, as ratings reported in these studies may be greater than the tendency of an individual to actually perform these safety behaviours.

The present analysis is perhaps the first to objectively analyse the safety communication behaviours between dyads when they come into contact with a hazard. The findings reflect the findings established in the bystander effect literature. Latane and colleagues (eg. Latane & Darley, 1969; Latane & Rodin, 1969) were the pioneers of bystander literature and proposed that emergencies, where the bystander effect operates, are ambiguous situations, which prompts people to seek cues from others on how to respond. Although not empirically tested,

Latane and Rodin (1969) found that strangers would look confused and concerned when confronted with an emergency but would be unwilling to approach their partners about their concerns. They further found that friend pairs would communicate their concerns better, often discussing with each other about how to respond to the emergency. The present study provides empirical evidence to support these prior evaluations made by Latane and Rodin, as dyads with stronger relationships were significantly more likely to demonstrate conversational discussion during within-dyad voicing; where members openly exchanged and negotiated discussion, ideas, and opinions (Kent & Taylor, 1998).

Practical Implications

Burt et al. (2008) suggested that interventions should be used during socialisation of a new employee or team to help them familiarise themselves with other employees. Interventions that promote the acquisition of knowledge about colleagues, will boost relationship strength, and promote greater safety communication and behaviours (Burt et al., 2008). The present analysis supports this proposition, as individuals with stronger relationships with a colleague voiced safety concerns to them more frequently. There was not enough evidence to suggest that stronger relationships actually promote further hazard removal and safety communication to supervision. However, all instances of reporting voice were preceded by within-dyad safety voicing, which suggests this may be an antecedent of further safety communication and behaviours. Therefore, interventions that promote knowledge gathering about co-workers to build relationship strength will promote greater voicing of safety concerns among colleagues, which may then generate further safety communication and behaviours.

Interventions are expected to help in high-risk environments with high employee turnover and where workers have fewer opportunities to engage in discussion with other employees. These conditions limit the production of long-term friendships and stronger relationships due to the reduced opportunity for an individual to obtain knowledge about their

colleagues (Burt et al., 2008). For instance, there is high-turnover amongst forestry workers due to their high-risk environment (Burt, 2015), additionally, forestry work involves the use of loud machinery during work, which doesn't provide employees with many opportunities to communicate. In these high-risk industries, it is important that employees have the opportunity through interventions to promote the acquisition of knowledge about a colleague, as this will develop strong work relationships, and increase safety communication.

The goal of the newly implemented Health and Safety at Work Act (2015) is to reduce death and serious harm due to work-related incidents by 25% by the year 2020 (WorkSafe New Zealand, 2017c). To achieve this employees and employers are legally required to minimise or eliminate work risks where possible. Employers are expected to provide hazard reporting systems, where work risks identified by employees can be removed in a systematic manner (WorkSafe New Zealand, 2016). Effective safety systems require employee engagement and safety communication; where all work-related hazards identified by employees are reported and subsequently eliminated (WorkSafe New Zealand, 2016). Evidence from the present study suggests that even after recognising a hazard people may seldom report or remove the hazard. An individual may communicate a safety concern to a colleague, which can be beneficial for the immediate safety of that colleague. However, the absence of further hazard correction or reporting may result in others being exposed to the hazard, increasing the chance an accident would occur (Reason, 2000). The present findings suggest that the expectation of employees by the Health and Safety at Work Act may be unrealistic, and prove insufficient in achieving the goal of the legislation as the systems implemented by employers continue to fail due to low levels of reporting voice and neutralising behaviours by employees.

Methodological Considerations

The conclusions drawn from the present study should be considered in light of its methodological limitations. A prominent limitation of the present analysis is the

generalisability of the data. This is restricted due to the sample used and the environment the study was conducted in. The sample predominantly consisted of young university students. The average age of the sample was 22.15 years, which is markedly lower than the majority of employed individuals in New Zealand (Statistics New Zealand, 2017). Tucker and Turner (2013) found that younger individuals have a tendency to employ a “wait and see” approach in regard to work hazards, rather than voicing safety concerns. The sample may have reported and demonstrated neutralising behaviours less than the general working population, due to the tendency to avoid confronting work hazards.

The friend group in the study was self-allocated, which may limit the findings generalisability to working groups. The present study was quasi-experimental, where group allocation was based on individuals choosing to participate with a stranger or a friend that they brought to the study. Participants in the friend group could choose who they would like to participate with and were likely to bring an individual they felt positively towards. This self-allocation differs from many working environments where management and recruiters dictate an employee work group. Burt et al. (2008) suggested that knowledge is the prerequisite of positive safety attitudes towards colleagues. However, the knowledge they gain may develop positive, negative, or neutral opinions about the colleague (Burt et al., 2008). People that hold positive opinions are likely to be more concerned about the safety of these colleagues. So, the influences of relationship strength as indicated by relationship tenure found by the present study may only be related to within-dyad safety voicing due to these positive opinions shared among the participants in the friend group. We could not expect the same level of within-dyad voicing between workgroups that may contain people with negative opinions of one another.

Finally, the hazard laboratory environment is limited in its generalisability to broader work environments. The hazard laboratory was set up in a similar way to an office space (see Figure 1), utilising common office hazards which were predominantly static physical or

chemical hazards (See Table 1) (Comcare, 2016; WorkSafe Victoria, 2006). Although the study is ecologically valid, as it reflects real-life conditions, the results cannot be generalised to non-office based environments, such as a factory or mechanic workshops. In reality, there are many different hazards of different types that permeate the work environment. The present study can only indicate how people respond to the hazard types used in the study in office conditions. Future research should attempt to expand on the present findings to investigate voicing in an objective manner across a myriad of environments and hazard types. For instance, investigating reporting of psychosocial hazards such as workplace bullying. Until further research has been conducted to establish generalisability, the findings of the present study should be taken tentatively.

Future Research

Safety voicing research is beginning to mature, but further analysis is required to identify predictors of this behaviour. Future research should focus on maintaining objective measurement over self-report measurement, to remove response biases and produce data that provides a realistic indication of safety communication. The present findings have found that relationship strength is a significant predictor of within-dyad voicing, but was unsuccessful in producing a significant association between relationship strength, reporting voice, and neutralising behaviours. Current objective research on safety voicing (See. Marwick, 2017; Davies, 2016) echo these results as they have also failed in producing a significant predictor of reporting safety voice. Future researchers should persevere and investigate what prompts individuals to demonstrate reporting voice or neutralise hazards.

As there is established evidence that within-dyad voicing is predicted by relationship strength, future research should attempt to analyse how this voicing type is used to make decisions to report or neutralise hazards. The results produced in the present study have indicated that conversational discussion during within-dyad voicing preceded reporting voice

in both groups and that this communication type was used significantly more by individuals in the friend group. Although audio transcribing could not be completed in the present study due to financial, ethical, and time constraints, prospective researchers should use this technique to identify how the hazard discussion is used differently by participants to then produce reporting or correction. This research could help inform interventions that prompt effective communication methods that promote safe behaviour.

Individuals partnered with a low safety conscious participant was detrimental for voicing, however, this needs to be tested empirically. It is likely this is similar to findings from bystander literature which suggest that people that are partnered with non-acting confederates were significantly less likely to respond to an emergency (Latane & Rodin, 1969). Future researchers may also choose to review the similarities between bystander effect literature and safety voicing literature as there appear to be resemblances between the streams of research. For instance, Ramsey's (1989) accident sequence model of identifying and responding to hazards is similar to the cognitive processes of intervention suggested by Latane and Darley (1969). If there are marked similarities between these literature streams, then potential predictors of safety voice and correction could be drawn from this research.

In conclusion, safety voicing is promoted by relationship strength, but only amongst peers. Results demonstrated that it is uncommon for individuals to choose to report or neutralise a hazard after noticing a hazard. This poses issues for current Health and Safety legislation in New Zealand, which requires employee safety voicing and neutralising behaviours to achieve a reduction in deaths and serious harm due to workplace incidents. The present study is perhaps the first to objectively measure within-dyad voice and produce a significant predictor, which can be used to guide future workplace health and safety interventions. Although not empirically tested, conversational discussion during within-dyad voicing preceded every instance of reporting voice, but only in instances where the voicing

individual was partnered with a participant with high safety consciousness. Future studies should explore this relationship and test if these findings are consistent across different work environments and hazard types. If this is the case, this would provide further evidence that co-workers impact employee safety behaviours and communication. However, as the safety voicing literature develops and becomes established, this should inform workplace safety systems and interventions to ensure as many New Zealanders as possible go home healthy and safe at the end of a workday.

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Appendix

Appendix A- Advertisement

Research Participants Wanted!



Participants are wanted for a study on competition amongst friends.

Who do we need?

- Yourself and a friend that you have known for at least a year

Or

- Just yourself! (To be paired with a stranger)

When?

- At a time organised to suit you and another participant (Either your friend or a stranger)

Where?

- Psychology Room 107 (Staff Block)

What's required?

- Forty minutes of your time to complete
 - A common buzz wire game with another participant
 - A small questionnaire

Open to all undergraduate students at the University of Canterbury

Participants will be rewarded with a \$10 *Cafe101* voucher!

If you are interested in participating, please email Samara at Samara.Hodges@pg.canterbury.ac.nz for more information

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Appendix B – Larger images of artificial hazards

Broken Glass



Falling Chemical Bottle



Smoke alarm without battery



Microwave with a metal bowl



Appendix B – Larger images of artificial hazards continued

Sparking Heater



Water near multi-plug



Lamp with exposed wire



Handle with exposed wire



Appendix C – Participant view during the experiment



Appendix D - Questionnaire

Questionnaire

The purpose of this survey is to study your safety behaviour and awareness of your surroundings. This questionnaire has two pages. Please read each item carefully. Please tick or circle relevant responses, and provide more information where necessary.

Participant Code:

1. Gender:

- ☐ Male
- ☐ Female
- ☐ Other

2. What is your age?

3. What is the nature of the relationship you have with the participant you worked with today?

(Select as many as relevant)

- ☐ Family
- ☐ Friend
- ☐ Romantic Partner
- ☐ Stranger (If yes, go to question 5)
- ☐ Other Please specify:

4. How long have you known the participant you worked with?

Months Years

5. The following statements are about your safety behaviour. Please circle the number that

reflects the extent you disagree or agree with the statement.

	Strongly disagree agree	Strongly
I always take extra time to do things safely	1 2 3 4 5	
People think of me as being an extremely safety-minded person	1 2 3 4 5	
I always avoid dangerous situations	1 2 3 4 5	
I take a lot of extra time to do something safely even if it slows my performance	1 2 3 4 5	
I often find myself making sure that other people do things that are safe and healthy	1 2 3 4 5	
I get upset when I see other people acting dangerously	1 2 3 4 5	
Doing the safest possible thing is always the best thing	1 2 3 4 5	

Appendix C cont.

6. The following statements are about your awareness of your surroundings in the buzz wire game room. For each statement please indicate if it is a true or false statement, and tick the box that best reflects your confidence in the assessment.

Statement	Assessment	Confidence
There is a drawing of a bear on the wall	<input type="checkbox"/> True <input type="checkbox"/> False	<input type="checkbox"/> Very high <input type="checkbox"/> High <input type="checkbox"/> Moderate <input type="checkbox"/> Low <input type="checkbox"/> Very low
There are two fire extinguishers in the room	<input type="checkbox"/> True <input type="checkbox"/> False	<input type="checkbox"/> Very high <input type="checkbox"/> High <input type="checkbox"/> Moderate <input type="checkbox"/> Low <input type="checkbox"/> Very low
There is carpet on the floor of the room	<input type="checkbox"/> True <input type="checkbox"/> False	<input type="checkbox"/> Very high <input type="checkbox"/> High <input type="checkbox"/> Moderate <input type="checkbox"/> Low <input type="checkbox"/> Very low
There is a phone in the room	<input type="checkbox"/> True <input type="checkbox"/> False	<input type="checkbox"/> Very high <input type="checkbox"/> High <input type="checkbox"/> Moderate <input type="checkbox"/> Low <input type="checkbox"/> Very low
There is a rubbish bin in the room	<input type="checkbox"/> True <input type="checkbox"/> False	<input type="checkbox"/> Very high <input type="checkbox"/> High <input type="checkbox"/> Moderate <input type="checkbox"/> Low <input type="checkbox"/> Very low
The bench top in the room is red	<input type="checkbox"/> True <input type="checkbox"/> False	<input type="checkbox"/> Very high <input type="checkbox"/> High <input type="checkbox"/> Moderate <input type="checkbox"/> Low <input type="checkbox"/> Very low
There is a clock in the room	<input type="checkbox"/> True <input type="checkbox"/> False	<input type="checkbox"/> Very high <input type="checkbox"/> High <input type="checkbox"/> Moderate <input type="checkbox"/> Low <input type="checkbox"/> Very low
There is a toaster in the room	<input type="checkbox"/> True <input type="checkbox"/> False	<input type="checkbox"/> Very high <input type="checkbox"/> High <input type="checkbox"/> Moderate <input type="checkbox"/> Low <input type="checkbox"/> Very low
There is a hard hat in the room	<input type="checkbox"/> True <input type="checkbox"/> False	<input type="checkbox"/> Very high <input type="checkbox"/> High <input type="checkbox"/> Moderate <input type="checkbox"/> Low <input type="checkbox"/> Very low
There is a candle in the room	<input type="checkbox"/> True <input type="checkbox"/> False	<input type="checkbox"/> Very high <input type="checkbox"/> High <input type="checkbox"/> Moderate <input type="checkbox"/> Low <input type="checkbox"/> Very low

Thank you for your participation. Please see the experimenter for debriefing

Appendix E - Scoring Sheets

Within-Dyad Voicing Scoring Sheet

Participant dyad code:	Discussing the hazard			
	Was hazard discussion initiated?	Time into experiment	Number of words involved in hazard discussion	Discussion type
Broken Glass	<input type="checkbox"/> Yes Who?			<input type="checkbox"/> Statement <input type="checkbox"/> Conversation
Faulty Heater	<input type="checkbox"/> Yes Who?			<input type="checkbox"/> Statement <input type="checkbox"/> Conversation
Water near multi-plug	<input type="checkbox"/> Yes Who?			<input type="checkbox"/> Statement <input type="checkbox"/> Conversation
Microwave with a metal bowl	<input type="checkbox"/> Yes Who?			<input type="checkbox"/> Statement <input type="checkbox"/> Conversation
Smoke alarm without battery	<input type="checkbox"/> Yes Who?			<input type="checkbox"/> Statement <input type="checkbox"/> Conversation
Falling chemical bottle	<input type="checkbox"/> Yes Who?			<input type="checkbox"/> Statement <input type="checkbox"/> Conversation
Lamp with exposed wire	<input type="checkbox"/> Yes Who?			<input type="checkbox"/> Statement <input type="checkbox"/> Conversation
Exposed wire on handle	<input type="checkbox"/> Yes Who?			<input type="checkbox"/> Statement <input type="checkbox"/> Conversation

Reporting Voice and Corrective Behaviour Scoring Sheet

Participant dyad code:	Reporting the Hazard		Hazard Correction	
	Was hazard reported?	Time into experiment	Was the hazard corrected?	Who corrected the hazard?
Broken Glass	<input type="checkbox"/> Yes Who?		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Participant <input type="checkbox"/> Experimenter
Faulty Heater	<input type="checkbox"/> Yes Who?		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Participant <input type="checkbox"/> Experimenter
Water near multi-plug	<input type="checkbox"/> Yes Who?		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Participant <input type="checkbox"/> Experimenter
Microwave with a metal bowl	<input type="checkbox"/> Yes Who?		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Participant <input type="checkbox"/> Experimenter
Smoke alarm without battery	<input type="checkbox"/> Yes Who?		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Participant <input type="checkbox"/> Experimenter
Falling chemical bottle	<input type="checkbox"/> Yes Who?		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Participant <input type="checkbox"/> Experimenter
Lamp with exposed wire	<input type="checkbox"/> Yes Who?		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Participant <input type="checkbox"/> Experimenter
Exposed wire on handle	<input type="checkbox"/> Yes Who?		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Participant <input type="checkbox"/> Experimenter

Appendix F - Information Sheet

Department of Psychology

Samara.Hodges@pg.canterbury.ac.nz



Competition amongst Friends

Information Sheet for Participants

Kia Ora.

My name is Samara Hodges and I am currently pursuing my Masters of Science in Applied Psychology. To obtain my masters I am completing a dissertation to determine if stranger or friendship pairs exhibit greater competition. To investigate the influence of relationship strength on competition, participants will be asked to complete trials of a common buzz wire game with either a stranger or a friend. The participants will complete a small survey after the buzz wire game trials have been completed to explore variables that may be related to friendly competition.

If you choose to take part in this study, your involvement in this project will be to complete trials of a buzz wire game, where the goal is to move a metal wand along a wire quickly and with minimal error. This will be completed with another participant who will also complete trials of the buzz wire game. You will be required to record the other participant's accuracy during their trials, and they will record your accuracy during your trials. After the trials, you will individually answer a questionnaire. You will then be debriefed by the experimenter and be offered the chance to withdraw from the study. The experiment should take between 30 to 40 minutes to complete. 100-level psychology participants will receive course credit for their participation in the present study. Other participants will receive a \$10 *Café 101* voucher for their participation. These will be supplied at the end of the experiment.

Participation is voluntary and you have the right to withdraw at any stage without

penalty. You may ask for your raw data to be returned to you or destroyed at any point. If you withdraw, I will remove information relating to you. However, once analysis of raw data starts on the 28th of October 2017, it will become increasingly difficult to remove the influence of your data on the results.

The results of the project may be published, but you can be assured of the complete confidentiality of data gathered in this investigation. To ensure anonymity and confidentiality, you will be given a code on your consent form that will be placed on any raw data to de-identify it, but can be used to delete your raw data given withdrawal from the study. All data will be stored securely in a locked room in a locked cabinet; or within a password-protected folder on a password-protected computer. The consent forms will be stored separately from any raw data. Only the research team will have access to the data and all analysis of data will be at the group level, rather than individually. All data will be destroyed after five years, unless otherwise required by a journal publication. A thesis is a public document and will be available through the UC Library. Please indicate to the researcher on the consent form if you would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for a Master's of Science in Applied Psychology by Samara Hodges under the supervision of Chris Burt, who can be contacted at Christopher.Burt@Canterbury.ac.nz . He will be pleased to discuss any concerns you may have about participation in the project. This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)

Appendix G – Consent form

Department of Psychology

Samara.Hodges@pg.canterbury.ac.nz



Competition amongst Friends

Consent Form for Participants

- ☐ I have been given a full explanation of this project and have had the opportunity to ask questions.
- ☐ I understand what is required of me if I agree to take part in the research.
- ☐ I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- ☐ I understand that any information or opinions I provide will be kept confidential to the research team and that any published or reported results will not identify the participants or their institution. I understand that a thesis is a public document and will be available through the UC Library.
- ☐ I understand that all data collected for the study will be kept in locked and secure facilities and/or in password protected electronic form and will be destroyed after five years unless otherwise required by a journal publication.
- ☐ I understand the risks associated with taking part and how they will be managed.
- ☐ I understand that I can contact the researcher Samara Hodges (Samara.Hodges@pg.canterbury.ac.nz) or supervisor Chris Burt (Christopher.Burt@canterbury.ac.nz) for further information. If I have any complaints, I can contact the Chair of the University of Canterbury Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz)

By signing below, I agree to participate in this research project.

Name: _____ Signed: _____ Date: _____

Participant Code: _____

Email address (*for report of findings, if applicable*):

- ☐ Please tick this box if you would like to receive a summary of the results of the project via the email address provided above

This form should be returned to the experimenter by the end of the experiments debrief.

Appendix H- Debrief

The Effect of Relationship Strength on Safety Voicing

Samara.Hodges@pg.canterbury.ac.nz

Debrief

Thank you for participating in the present study. At this point you may have realised that the present study was not investigating competition between friends, but rather how the strength of the relationship between people may impact their tendency to talk about safety concerns (safety voicing). This relationship was examined by putting two people (either friends or strangers) in a room to complete a task, whilst the room contained fake hazards that participants could identify, discuss, or correct. The questionnaire was used to collect demographic information, check the relationship you have with the other participant, and for testing variables that may additionally impact your safety voicing.

It was hypothesised that participants that were with a friend would be more inclined to voice safety concerns to the other participant and to the experimenter, compared to participants with a stranger. We also predicted that friend pairs would demonstrate greater safety behaviour.

In order to create a measure of safety voicing between participants without the influence of experimenter's presence the discussion between you and the participant you were working with was covertly recorded within the experiment room. This will be listened to by the experimenter, and coded to measure how hazards were discussed. At this point in time the audio has not be listened to by anyone and can be immediately deleted. If you would like this deleted please immediately tell the experimenter. Otherwise, do you consent to its use?

☐ Yes

☐ No

The information drawn from this study will help identify if ensuring strong relationships between colleagues is crucial in increasing safety voicing. It will help to emphasise the importance of building relationships, which through safety voicing should reduce the high workplace accident rate.

It is crucial that the information that you have about this study remains completely confidential until data gathering ceases on the 27th of October, 2017. If individuals know about the study prior to their participation, they may behave in socially desirable ways. Confidentiality thus ensures that the data we gather is accurate and representative.

As you now know the true aims and interests of the study, post-debrief consent is necessary to ensure you are willing for the data to be used to research these study aims.

By signing below, you agree to participate in this research project.

Name: _____ Signed: _____ Date: _____

Again, thank you for your participation in the study. If you wish to withdraw your data from analysis please either inform the experimenter now or email either Samara Hodges (Samara.Hodges@pg.canterbury.ac.nz) or Chris Burt (christopher.burt@canterbury.ac.nz) before the 27th of October, 2017 . Data analysis begins on 28th of October. Only the experimenter and their supervisor will have access to any raw data.